Global Warming

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Las Vegas City Council Presentation
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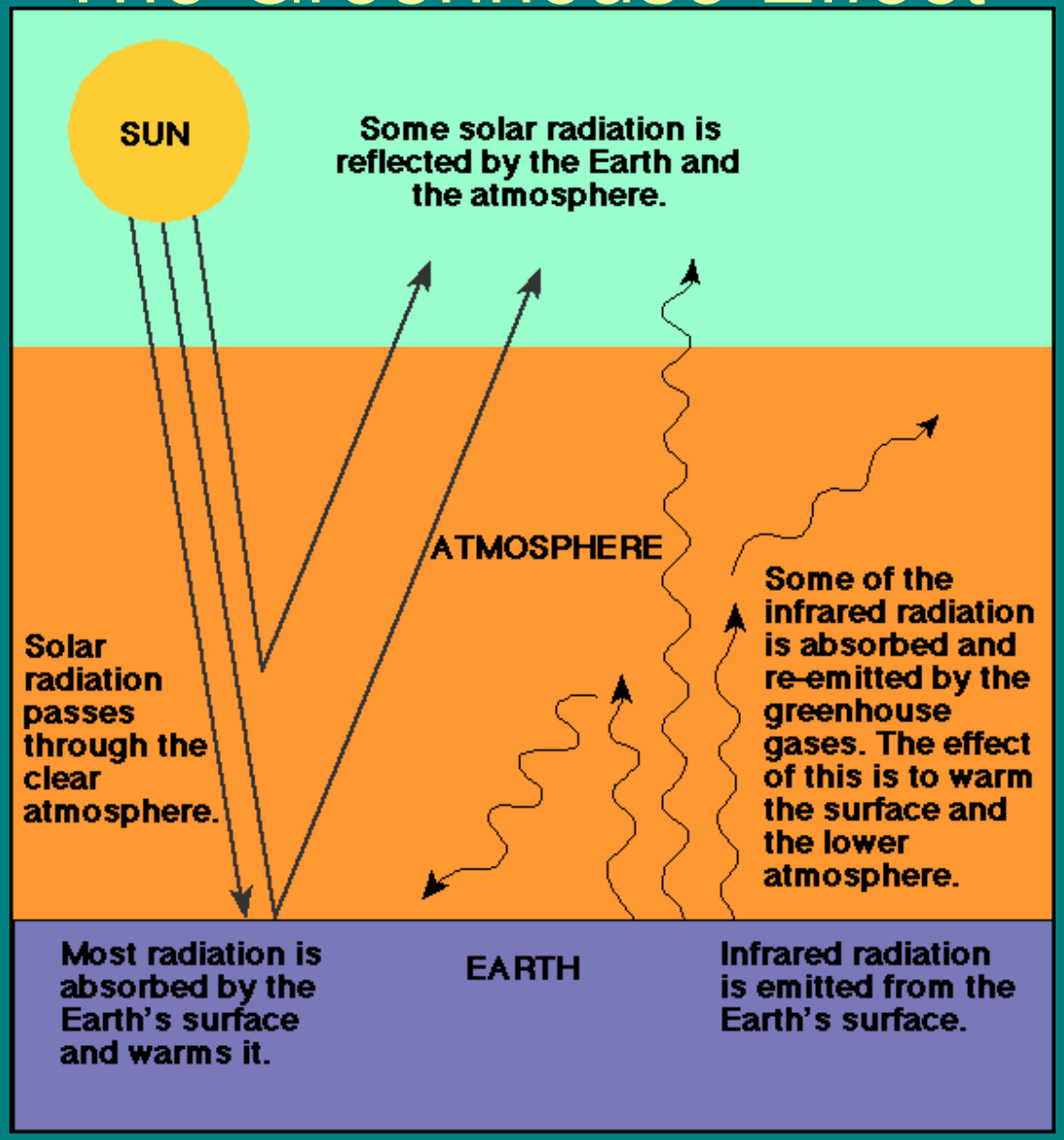
The Greenhouse Effect



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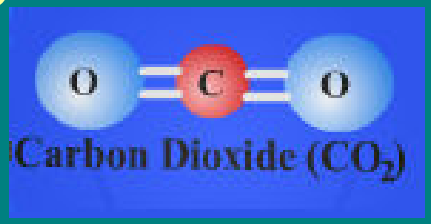
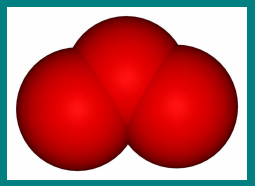
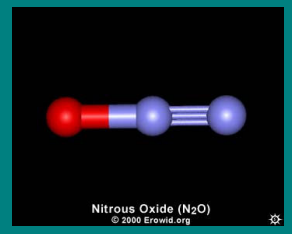
Greenhouse gases

- CO_2 (carbon dioxide)
- H_2O (water) – most effective
- N_2O (nitrous oxide)
- O_3 (ozone)
- CH_4 (methane)
- CO (carbon monoxide)
- SO_2 (sulfur dioxide)
- Among many others

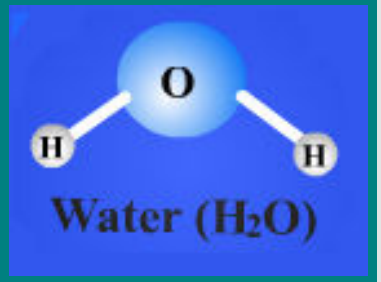


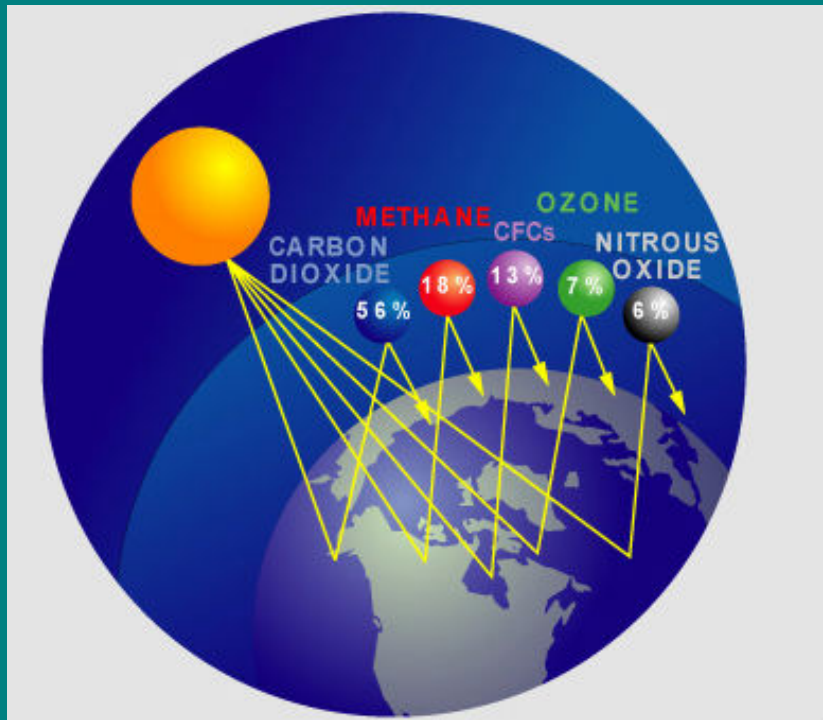


Ozone



Nitrous Oxide





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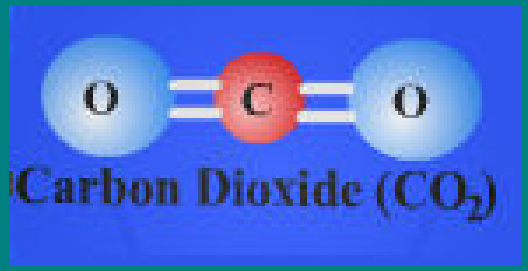
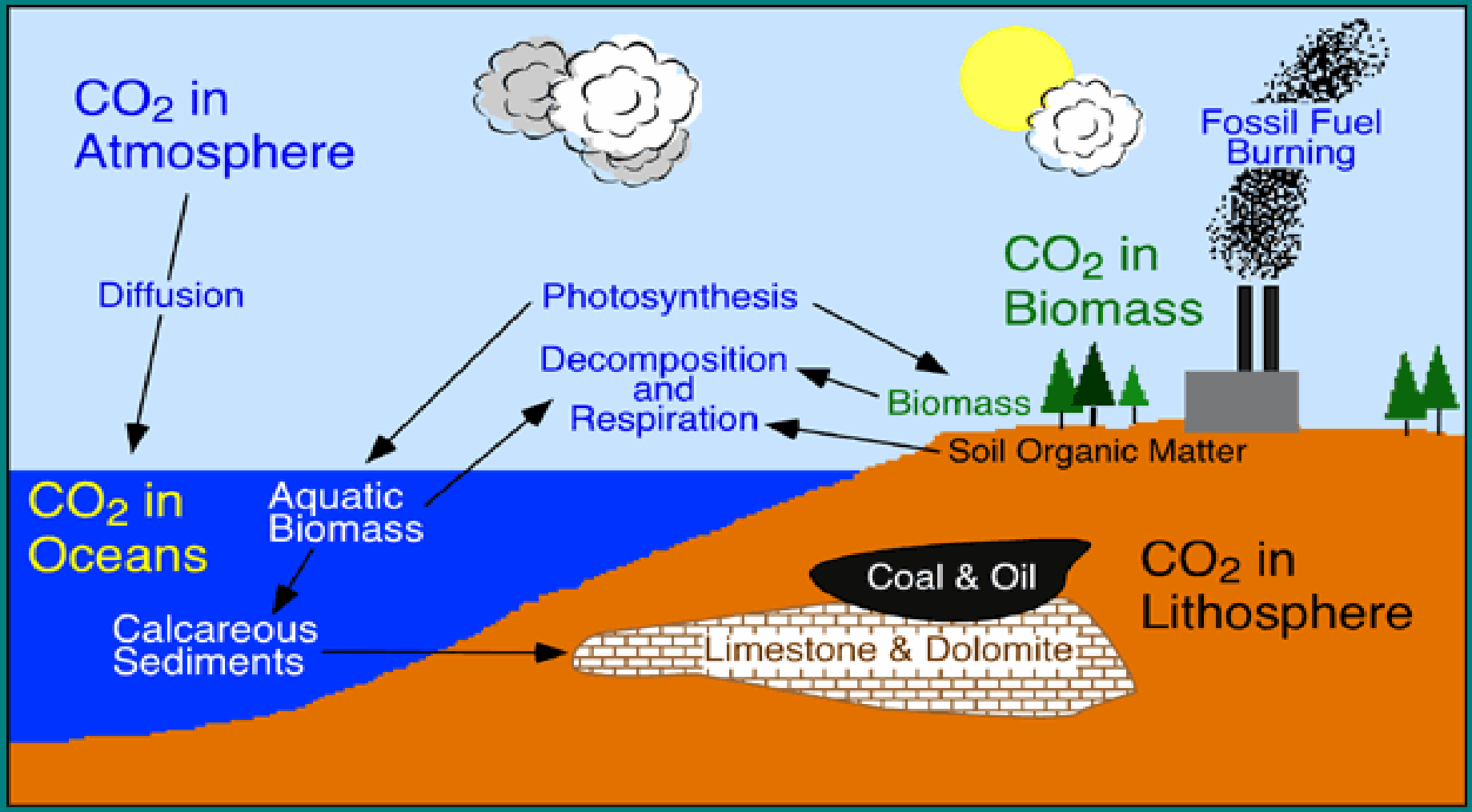
Carbon Dioxide (CO_2)



The primary sources of carbon dioxide in our atmosphere are from volcanoes, asteroid impacts, geothermal and natural wells, biological metabolism/respiration, and human/industrial activity. Carbon dioxide levels are now ~27% higher than at any point in the last 650,000 years. ***It lasts roughly 100 years in the atmosphere***. In 2001 carbon dioxide accounted for 83.7% of the total U.S. greenhouse gas emissions.

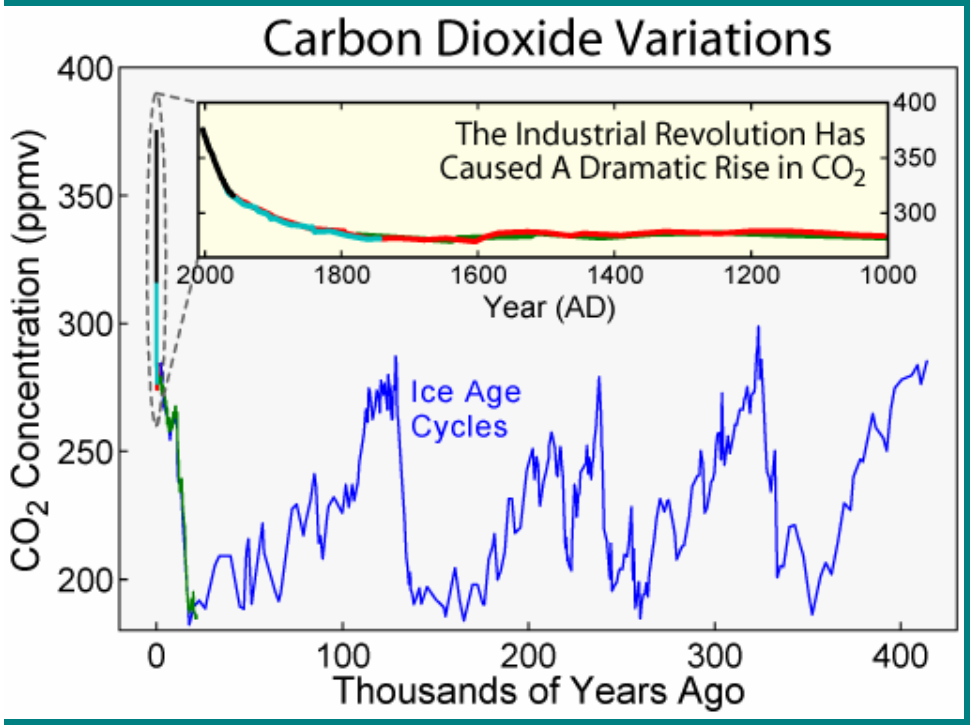
The Carbon Cycle (carbon is the skeleton of life).

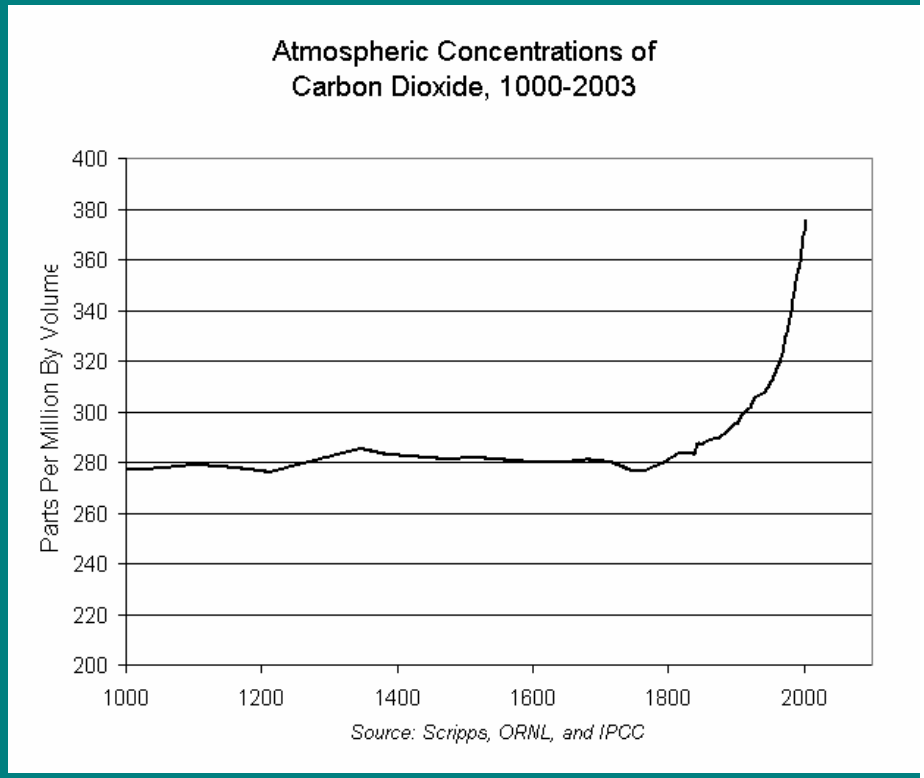


How much gas is produced by burning one gallon of gas?

- One gallon of gasoline weighs ~6.6 lbs.
- 5.6 lbs of one gallon of gas is pure carbon which gets converted into 20.2 lbs of CO_2 23 lbs of H_2O, i.e. ~43 lbs of greenhouse gases. These gases are ~1000-fold larger in volume when burned. Thus at least 4000 gallons of gases are produced.
- Our nation consumes 20 million barrels of oil every day (43% of the world's supply)! One barrel of oil = 42 gallons.

CO_2 variations versus time.





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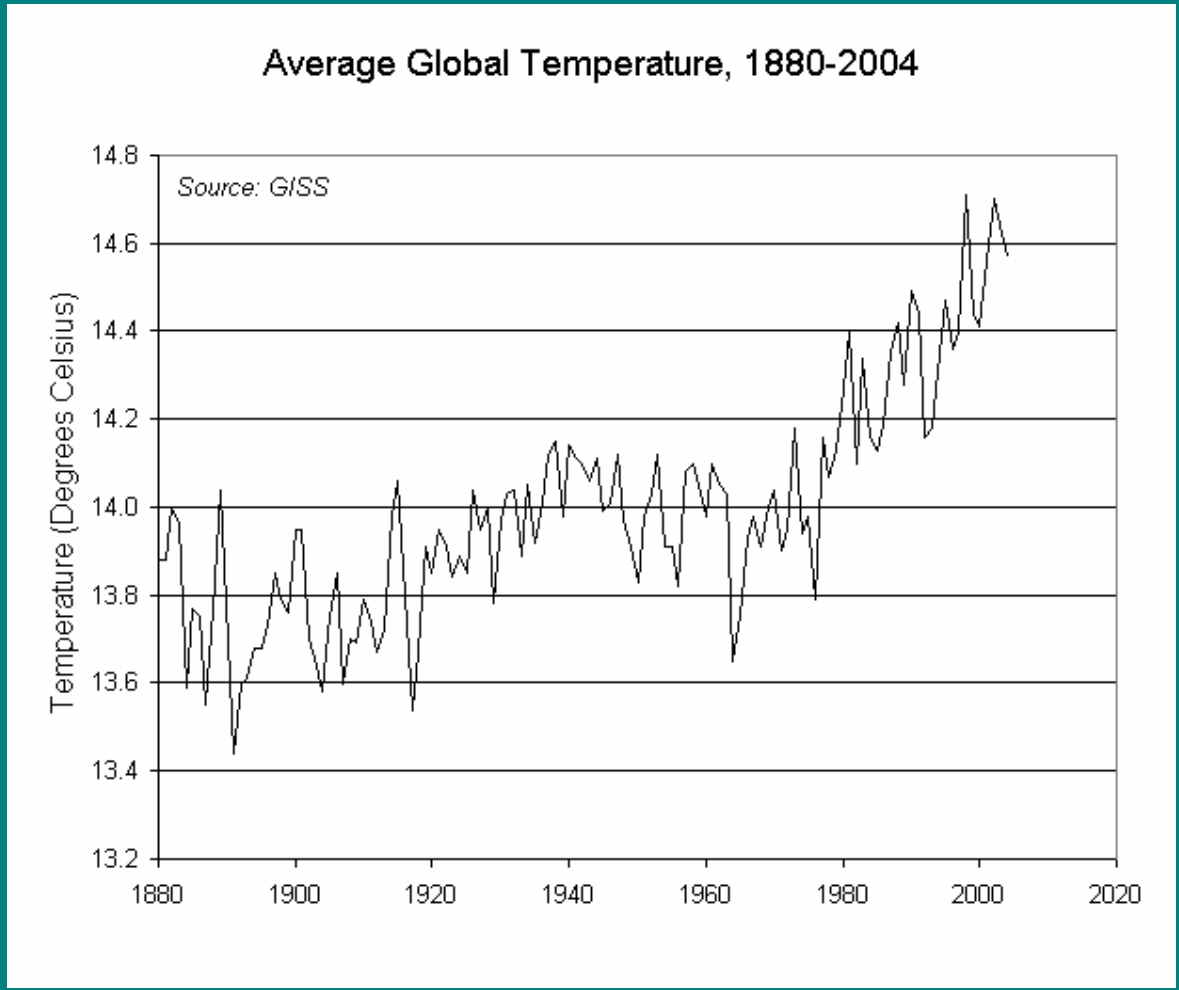

Source: Goddard Institute for Space Studies, NASA Goddard Space Flight Center, Earth Sciences Directorate, "**Global Temperature Anomalies in .01 C**," <http://www.giss.nasa.gov/data>, updated January 2005.

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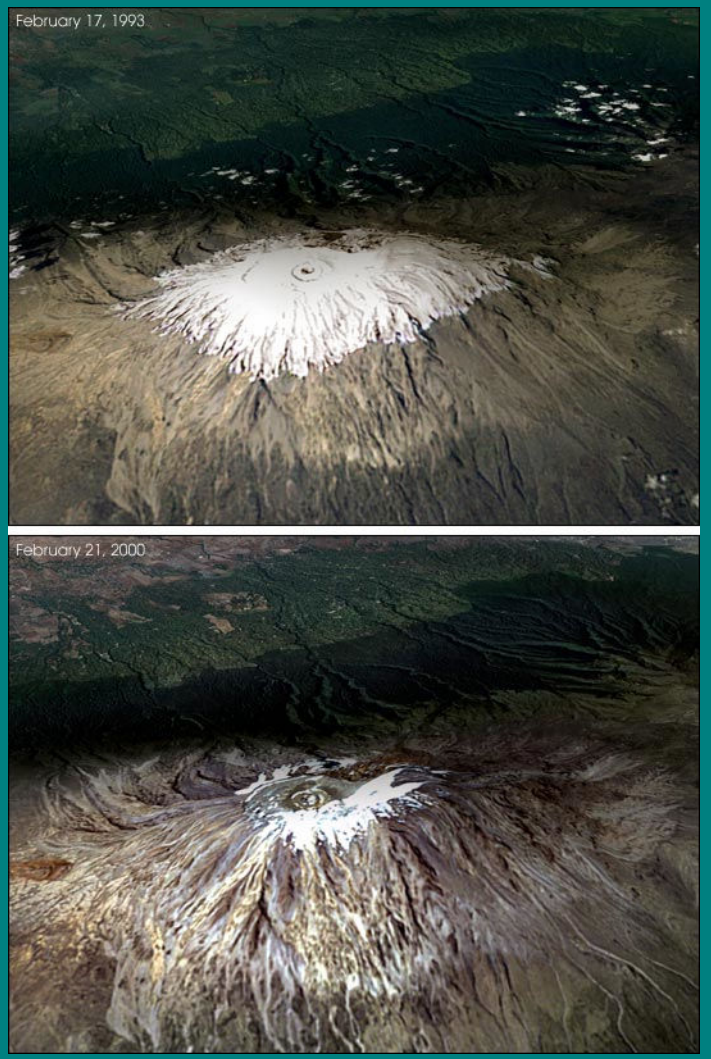
Some consequences of global warming.

- Increased temperatures of the oceans reduces the solubility of CO_2 in water (think of heating a pop bottle) and increases the vapor pressure of water above the ocean surfaces further releasing more greenhouse gases into the atmosphere causing more warming. Altered convection patterns on the wind and oceans hurts aquatic life. Warming of the oceans and surface hurts life (e.g. coral reefs).
- More fluctuations/extremes of weather.
- Reduction of reflection from snow and ice results in more absorption of heat from the Sun resulting in further melting. The warming rate in the North Pole is twice as fast as elsewhere.
- Sea levels have risen worldwide approximately 15-20 cm (6-8 inches) in the last century. Estimates are that it could rise 20 ft with the melting of glaciers on e.g. Greenland and Antarctica.
- Melting of glaciers also releases trapped greenhouse gases back into the atmosphere.
- Runaway conditions (positive feedback).

Melting of the glacier on Mt. Kilimanjaro in Africa.



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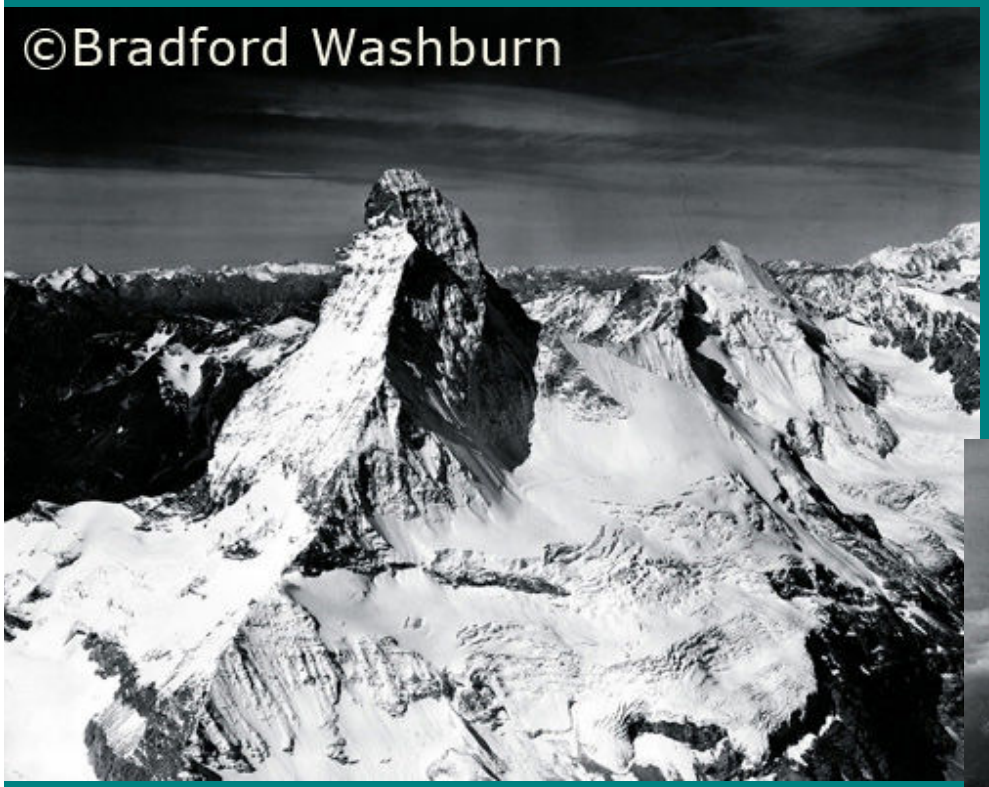
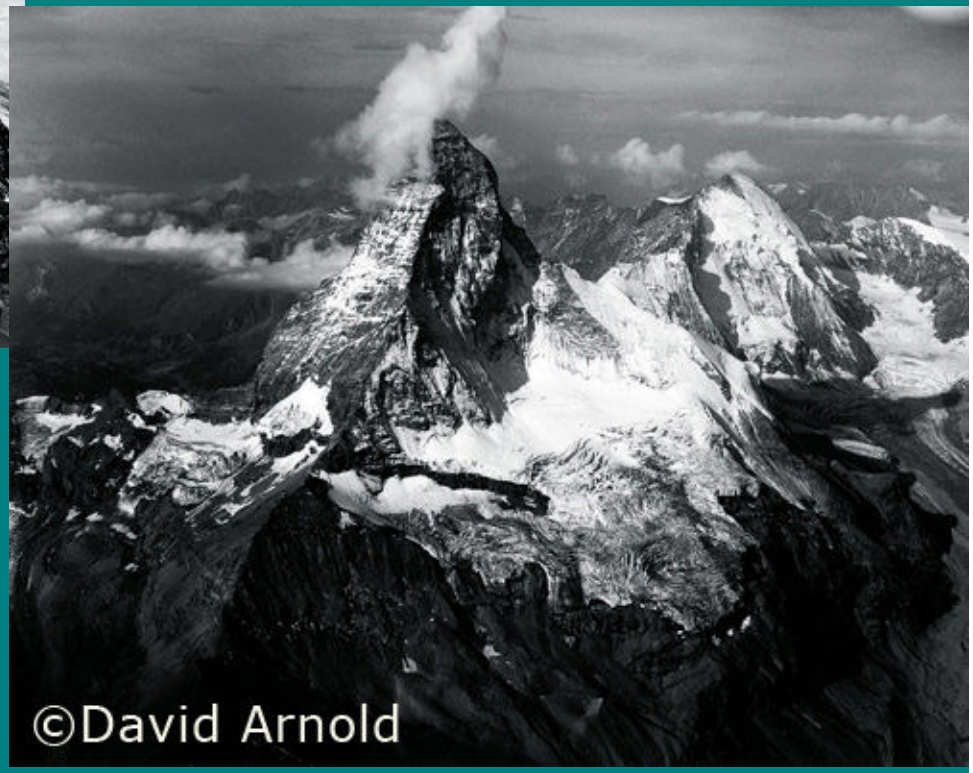


Matterhorn, c1960.



Matterhorn, c2005

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Points to consider

- Whenever rapid change occurs, all life suffers until it adapts to the new conditions.
- Life altered the harsh, primordial atmosphere of the Earth. All of the oxygen in our atmosphere was produced by living organisms.
- Smog is yet another example of dramatic changes in the local atmosphere as a result of human activities. Human-induced natural catastrophes are not new (Dust Bowl, Aztecs, tornadoes, etc.).
- We are experimenting on our only home – Mother Earth. The ultimate results of the experiment may not be known for some time and may become irreversible.
- Quote from the *Seattle Times* ("The truth about global warming," October 9, 2005): "There's a huge disconnect between what professional scientists have studied and learned in the last 30 years, and what is out there in the popular culture…Most scientists don't know how to communicate their complex results to the public. Others are scared off by the shrill political debate over the issue. So their work goes on largely unseen, and largely pointing to a warmer future."
- Same article: "1,000 research papers on climate change (were) selected randomly from those published between 1993 and 2003. The results were surprising: Not a single study explicitly rejected the idea that people are **warming** the planet."

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Can we reverse the apparent trend? (Do we want to?)

- Reduce greenhouse gas emissions.
- Nuclear energy.
- Renewable energy – wind, geothermal, and solar (~1kW/m^2). An area roughly equal to Northern New Mexico dedicated solely to collecting solar power would satisfy the nation's current *total energy* needs.
- We need to build more support for science to find solutions. Engage scientists in the debate.
- Major efforts need to boost the level of science education in this country so that the public and leaders are better-informed on these issues.
- Create carbon sinks. Easiest way is to plant more trees. Stop decimating the rainforests.

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